BULLETIN 435 MAY, 1929

What Does it Cost to Grow a Bushel of Apples?

F. H. Ballou

OHIO
AGRICULTURAL EXPERIMENT STATION
Wooster, Ohio

CONTENTS

Introduction 3
Source of the Cost Account Data 4
The Dale View Orchard 4
Varieties Grown 5
The Orchard Operations 5
Transportation and Storage Costs 6
Items of Expense in the Production of Apples 7
Pruning 7
Fertilization of the Orchard 9
Spraying and Dusting Materials 11
Application of Sprays and Dusts 12
Gasoline and Oil 14
Thinning 14
Mowing the Orchard 15
Picking the Apples 16
Hauling the Apples to the Packing-house 16
Grading and Packing 16
Interest on Investment in Machinery and Equipment 17
Depreciation in Value of Machinery, Repairs 18
Interest and Taxes on Land 18
Total Cost per Bushel 18
Summary 19

The Promise of Springtime

Generous Fulfillment in Autumn

WHAT DOES IT COST TO GROW A BUSHEL OF APPLES?

F. H. BALLOU

INTRODUCTION

The question "What does it cost to grow a bushel of apples?" is one much more frequently and easily asked than answered.

Doubtless there are a number of reasons why detailed cost accounts in apple production are seldom kept by orchard owners. These need not be discussed here. It is fully as desirable for apple growers to know exactly what their fruit crops are costing and how the costs are apportioned among the many separate orchard operations and requirements upon which successful production depends, as to know what the gross financial returns amount to at the close of each season. Obviously the cost of growing and handling apples in Ohio will vary considerably because of widely differing topographical and sectional conditions.

Fig. 1.—The Dale View Orchard on April 30, 1921, during an unseasonable period of cold and snow. The trees had received their first after-bloom or petal-fall spray the day before the snow. This orchard, however, situated in a section well adapted to fruit-growing, successfully passed thru the frigid experience and was one of the few in Ohio that produced profitable crops in the year of 1921.

SOURCE OF THE COST ACCOUNT DATA

THE DALE VIEW ORCHARD

The data include the actual average cost, during the five-year period of 1924 to 1928, inclusive, of each of more than a dozen separate items of expense entering into the production of a bushel of apples, in the Dale View Orchard. The orchard is situated in southeastern Licking County, a very hilly section of central Ohio. The elevation of this farm above sea level ranges from 950 to 1150 feet.

This comparatively small commercial orchard contains about 20 acres. The trees on 10 acres of the area had been planted 12

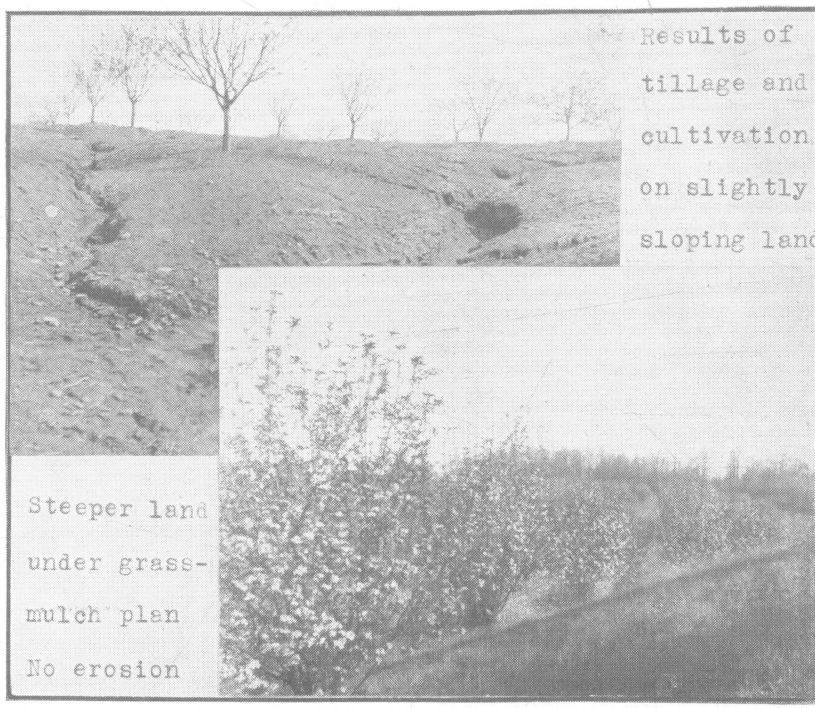

Fig. 2.—Two Ohio orchards of the same age, 11 years. After following the practice of annual tillage, cultivation, and growing of cover crops on slightly rolling orchard land in Ohio, the loss of soil by erosion had been so great that the owner of the orchard (above) abandoned tillage and seeded the ground to mixed grasses and legumes. The orchard below is on much steeper land under the grass-mulch plan of culture, in which the ground has remained untouched by plow or disk harrow. Not the slightest evidence of erosion can be found in this orchard, which is now coming freely into fruit production as indicated by the blossoms on the trees.

years at the beginning of this record. The other half of the orchard is occupied by trees that were from 20 to 25 years old at the outset.

The greater portion of the land on which this orchard is situated is very steep—the slopes inclining sharply to the north, northeast, and east. No part of the area is adapted to tillage and cultivation, because of the susceptibility of the soil to being washed away during heavy rainfall; therefore the grass-mulch plan of culture has been practiced from the time the trees were planted.

The soil is a silt loam, in which sandstones of various sizes abound. It ranges from moderately fertile to very thin and poor. This variation in quality of the land is overcome and its productive ability equalized by the use of commercial plant food material, principally of a nitrogenous character, at different rates of application according to soil requirements in various parts of the orchard.

VARIETIES GROWN

Six varieties of apples predominate in this orchard, namely, Delicious, Ensee, Grimes, Jonathan, Rome, and Stayman. About twenty-five additional varieties are grown on a small scale for exhibition purposes. The tendency of some varieties of apples to bear abundantly one year and but a small to moderate crop the next is well-known. Cropping has been so nicely balanced in this orchard that moderate annual production for the total area has been the rule. There has not been a single year that the entire area bore a full or maximum crop, nor has there been a single season of total crop failure since the older trees came into bearing some twenty years ago. During the last five years there has been an average annual production of 139 bushels per acre for the entire 20 acres.

THE ORCHARD OPERATIONS

All of the orchard operations at Dale View are performed by hired labor; they are, therefore, entirely on a cash basis. An efficient foreman, who owns a good team of horses, is employed regularly each season, being paid a certain sum per hour for man-hours and a higher rate for man-and-team hours. The foreman keeps a careful record, on daily time-sheets, of the number of hours devoted to each of the various orchard operations. These time-sheets, at the close of each season, contain a complete memorandum of the year's activities, from which a cost account readily may be compiled. The foreman is provided with helpers at such periods as assistance may become necessary, and he keeps separate records of the time and character of work of these part-time employees.

TABLE 1.—Cost Per Bushel of Growing and Handling 13,900 Bushels of Apples for the Five Years, 1924 to 1928, Inclusive The Dale View Orchard, Licking County, Ohio

Items of cost	1924	1925	1926	1927	1928	Average per year for 5-yr. period
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Pruning the trees and gathering, hauling out, and burning the brush	3.1	2.6	2.4	2.1	5.0	3.04
Fertilizer and its application	2.0	2.3	2.4	1.6	1.8	2.02
Spraying materials in 1924–5–6, and spraying and dusting materials in 1927–8	3.8	3.1	3.1	4.1	6.5	4.12
Spraying in 1924–5–6, and spraying and dusting in 1927–8	5.3	5.1	6.8	3.3	4.6	5.02
Gasoline and lubricating oil	0.5	0.4	0.5	0.3	0.3	0.4
Thinning apples (new project in 1928)	.....	.. ....	.....	.....	8.5	1.7
Mowing orchards twice each season, including work with mowing machine and scythe	3.1	2.6	2.9	3.0	4.0	3.12
Picking apples	11.6	10.0	10.0	10.0	10.0	10.32
Hauling apples from orchard to packing-house	4.6	3.1	3.8	3.5	2.4	3.48
Grading and picking the fruit, exclusive of supervision	3.2	4.3	4.5	8.7	8.9	5.92
Supervision of packing and local sales	3.8	2.6	2.9	2.5	3.5	3.06
Interest on investment in orchard machinery and equipment, at 6 percent	2.0	1.5	1.2	2.2	4.7	2.32
Repairs and depreciation in value of machinery and equipment at 10 percent per year	3.3	2.5	2.0	3.7	7.9	3.88
Interest on assessed value of orchard land, plus taxes on land and equipment	2.2	1.9	1.7	3.1	4.3	2.64
Cost of 1-bushel basket, liner, and cap	20.0	18.0	18.0	20.0	18.0	18.8
Total cost of each 1-bushel basket of apples, packed and lidded ready for storage or market	68.5	60.0	62.2	68.1	90.4	69.84

TRANSPORTATION AND STORAGE MAY ENTAIL ADDITIONAL COSTS

Since many orchardists dispose of their apples at their own packing-house or roadside market, the total cost is made to include all items of expense of production and handling up to the time the packing is finished and the fruit ready for the buyer. But where it is necessary for the grower to deliver his apples in a more or less distant market, there will be an additional expense for transportation.

Moreover, in the absence of storage facilities at the orchard, should it be desirable to hold the apples for market later in the winter, there will be both transportation and storage charges to pay. From the Dale View Orchard transportation to the nearest

city market, 9 miles distant, cost 7 cents per 1-bushel basket. Cold storage at the same point of destination cost 10 cents per bushel basket for the first month and 8 cents per month thereafter.

DISCOURAGING OR ENCOURAGING—WHICH?

The foregoing detailed cost account of production and preparation of a bushel of apples for market may prove somewhat depressing to the actual or prospective orchard owner who is engaged in some other business or in some profession; who does not reside on his fruit farm; who must furnish all equipment, materials, and supplies; who must depend wholly upon hired labor, and must pay cash for every service rendered by those to whom he entrusts every detail of growing, harvesting, and preparation of the fruit for market or storage.

On the other hand, this cost account is encouraging when carefully studied by the apple orchard owner who resides on the fruit farm; who owns horses or a tractor, or both; and who personally exercises supervision over his orchard enterprise, and takes active part in all of the details of growing, harvesting, grading, packing, and marketing the fruit. It is safe to assert that such orchardists will continue to receive substantial remuneration from the production of fine apples long after many non-resident investors in extensive and spectacular orchard enterprises have failed and gone out of business.

IMPORTANT ITEMS OF EXPENSE IN THE PRODUCTION OF APPLES

PRUNING NECESSARY TO SUCCESSFUL APPLE PRODUCTION

Pruning to admit sunshine and favor unobstructed circulation of air in all parts of the trees and to facilitate thoro spraying or dusting, is a fundamental requisite in growing apples of acceptable size and good color and free from imperfections—especially such defects as result from attacks by various fungous diseases.

A moderate amount of annual pruning was done at the Dale View Orchard during the years of 1924 to 1927, inclusive. It was directed chiefly to the removal of broken branches; those that grew toward the centers of the trees, or toward other and more valuable branches; the less promising of those that crossed or closely paralleled each other; and the water-sprouts or strong, succulent, upright growths which persist in springing out, annually from the bodies and larger branches of the trees.

This moderate pruning each year, it may be noted in the foregoing table, added an average cost of 3.04 cents per bushel of apples for the four crops of 1924 to 1927.

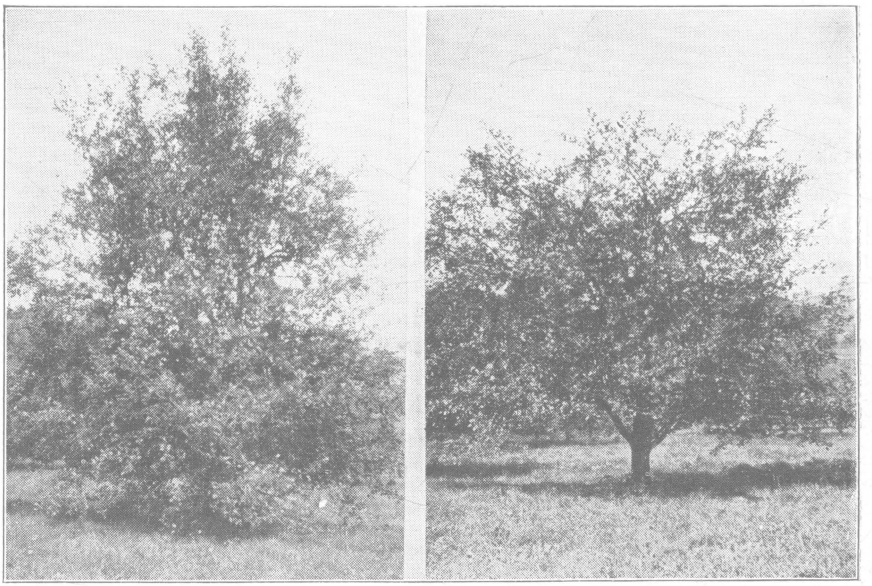

Fig. 3.—Tree in need of corrective pruning; the same tree after pruning

During the winter of 1927-28 the orchards were given a general, rather heavy pruning, which had become advisable. Resulting from a number of seasons of heavy fruit production, many of the lower or under branches of the low-headed trees were lying flat on the ground and had become overgrown and densely shaded by more vigorous branches that had developed above. These low, or ground branches were removed, since they were no longer useful in the production of apples of good size and color and seriously interfered with the work of keeping the ground in a clean and neat condition. Many branches in the crowded central parts of the trees, which were deprived of sunshine because of their inaccessible positions, were removed. The heads of the trees, in many cases, were materially lowered and rounded into a greater degree of symmetry by "heading-in" the straggling, unduly tall top-growths and side-branches, by cutting just above or beyond conveniently located laterals.

In the aggregate there was an immense amount of wood removed from the 20 acres of trees, gathered, hauled out of the

orchard and burned. The expense, had it been charged solely to the succeeding crop of 1928, would have amounted to 13.9 cents per bushel of apples. However, as no equally heavy pruning will be necessary for at least three years, charging the whole cost of this pruning to one crop would be unfair. This being true, only one-third of the cost of the pruning work of the winter of 1927-28, and the cost of a small amount of light summer clipping with the hand shears previous to apple harvest, are charged against the crop of 1928. This expense, as shown in the table, amounted to exactly 5 cents per bushel, or just double the average cost of the annual prunings of the four preceding years. The remaining two-thirds of the cost of the general, heavy pruning will be apportioned to the crops of 1929 and 1930, in addition to the expenses incurred by additional light annual pruning that may be required to maintain the trees in good form.

FERTILIZATION OF THE APPLE ORCHARD

There are few, if any, upland soils in Ohio which, under the grass-mulch plan of culture so generally practiced to prevent erosion of sloping ground and steep hillsides, do not require fertilization for satisfactory results in apple production. On thin, poor land yields of apples often are doubled, trebled, or even quadrupled by the use of proper, quickly available chemicals. The element of fertility that is generally lacking in these upland and hilly sections of the State is nitrogen. This is supplied by the use of either nitrate of soda or sulfate of ammonia, scattered or "sown" on the surface of the ground, when the grass is dry, in circles or belts around the individual trees, beneath the outermost extremities of the horizontal branches.

No definite rule can be laid down for regulating the amounts of nitrogenous plant food for trees of different ages, because of the widely varying soils of different apple orchards. Even in a single orchard, in many instances, there may be found soils of different types and degrees of fertility. However, for average thin, unproductive, upland soils in Ohio, nitrate of soda safely may be used at the rate of one-fourth pound per tree for each year of the tree's age, counting from the time it was planted. Quite possibly this may not be sufficient for trees of bearing age and size, occupying extremely poor ground. On the other hand, should the soil be moderately fertile, this rate of application may be somewhat excessive. Equally as satisfactory results in orchard fertilization

may be obtained by substituting sulfate of ammonia for nitrate of soda. However, as sulfate of ammonia is somewhat higher in nitrogen content than nitrate of soda, only four-fifths as much by weight need be used.

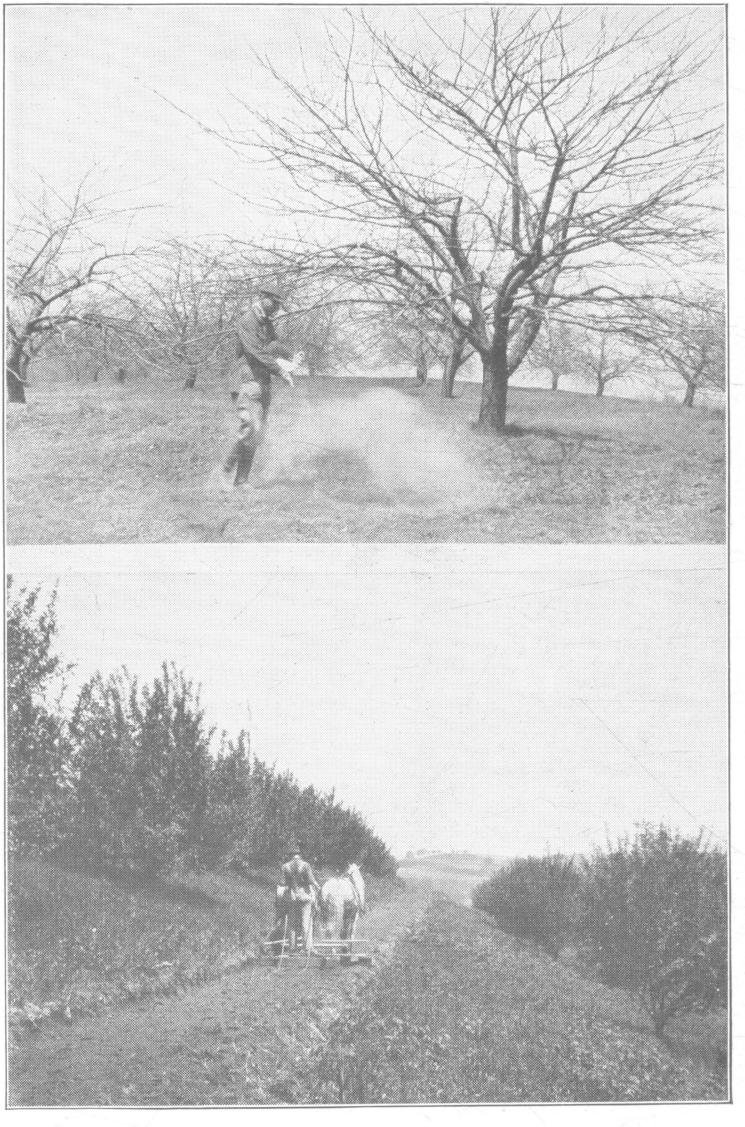

Fig. 4.—Scattering or "sowing" chemical fertilizer around an apple tree in a circle or belt beneath the outer extremities of the branches. Grading or "terracing" orchard driveways on a steep hillside.

At the Dale View Orchard, while nearly all of the soil is of a silt loam type, there is an unusually wide range of natural productive ability. The rate of fertilization, therefore, was regulated accordingly, or as nearly in proportion to actual requirements as may be done by exercising careful judgment. From 2½ to 5 pounds of nitrate of soda, or 2 to 4 pounds of sulfate of ammonia, was used per tree annually for bearing trees 16 years of age and above. Fertilization of these orchards, as may be noted in the tabular cost account, amounted to an average of slightly more than 2 cents per bushel of apples for the five-year period.

SPRAYING AND DUSTING MATERIALS

No spraying in the dormant or delayed dormant period in late winter or early spring, as so generally practiced, with strong lime-sulfur sprays, has been done at the Dale View Orchard since planting the younger trees in 1912, now 17 years. There has been very little trouble from San Jose scale, which, at each recurrence, was promptly eliminated by sprays of the oil emulsion or miscible oil type. The European red mite, which appeared in abundant infestation in the central portion of Ohio in 1928, probably will require somewhat more frequent oil sprayings in the future. Omission of dormant spray treatment in this orchard, except occasionally when really needed, has had much to do in holding the costs down to an unusually low level. No evil effect has been sustained by such omissions.

Previous to the season of 1927 the orchards under discussion were wholly under spray treatment for control of fungous diseases and insect enemies. Dry lime-sulfur, high grade hydrated lime, and powdered lead arsenate have been used exclusively for both before-bloom and after-bloom spraying ever since the first trial of this combination in the season of 1923, or for six successive seasons. The two formulas for earlier and later spraying are as follows: For pre-bloom applications, 3 pounds of dry lime-sulfur and 5 pounds of high grade hydrated lime to each 50 gallons of water. For all post-bloom spraying, 1½ pounds of dry lime-sulfur and 5 pounds of hydrated lime, plus 1¼ pounds of powdered lead arsenate to each 50 gallons of water. From the tabular cost account it may readily be seen that the expenditures for materials for these formulas amounted to an average of 3.3 cents per bushel of apples per year for the three seasons of 1924 to 1926, in which spraying, exclusively, was still in practice.

In the years 1927 and 1928 the orchard was utilized for rather extensive experiments in dusting in comparison with spraying. In fact all but about an acre of the orchard was included in the several plots that were treated thruout the two seasons exclusively with dusts of different kinds and various strengths. The dusts chiefly employed, however, were composed of superfine sulfur and high grade hydrated lime, with powdered lead arsenate.

On a few large plots dusts composed of as low as 50, 25, and even 10 percent of superfine sulfur were tested. The remaining 50, 65, or 90 percent of the total bulk of these dusts was made up of high grade hydrated lime, or lime and dry lead arsenate, according to requirements for the different, successive dustings. The main or larger block of trees of several varieties was treated thruout each season with a standard dust formula as follows: 80 percent of superfine sulfur and 20 percent of high grade hydrated lime for the pre-bloom dusting; 80 percent of sulfur, 10 percent of lime, and 10 percent of dry lead arsenate immediately following petal-fall, and 2 weeks and 10 weeks after bloom; 80 percent of sulfur and 20 percent of lime (the same as for pre-bloom treatment) 1 week and 3 weeks after bloom.

By reference to the table it may be seen that changing from spraying to dusting, in 1927 and 1928, even where dusting was done in part with unusually low percentages of sulfur, which is one of the more expensive constituents, the cost of these materials per bushel of apples was increased to an average of 5.3 cents as compared with the average of 3.3 cents for spraying materials used in 1924-1926. Obviously, had the usually recommended formulas of from 80 to 90 percent of superfine sulfur been used over the whole of the dusted area of the orchard, the cost per bushel of fruit would have been increased still further.

APPLICATION OF SPRAYS, AND OF DUST AND SPRAYS

It may be seen by referring to the orchard expense account that the work of applying the sprays in the three seasons of 1924-1926, average 5.7 cents per bushel of apples. On account of the steep hills of the orchard tract the equipment used was a light power sprayer with a single cylinder pump operated by a 2½ horsepower gasoline motor. The spray tank was one of 100 gallons capacity. The spray was delivered thru a line of hose 100 feet in length and single-nozzle spray gun.

In order to use a power spraying machine even of this light weight and easy draft, with a reasonable degree of safety, terraced or graded driveways were cut in the steep hillslopes every fourth space between the tree-rows.

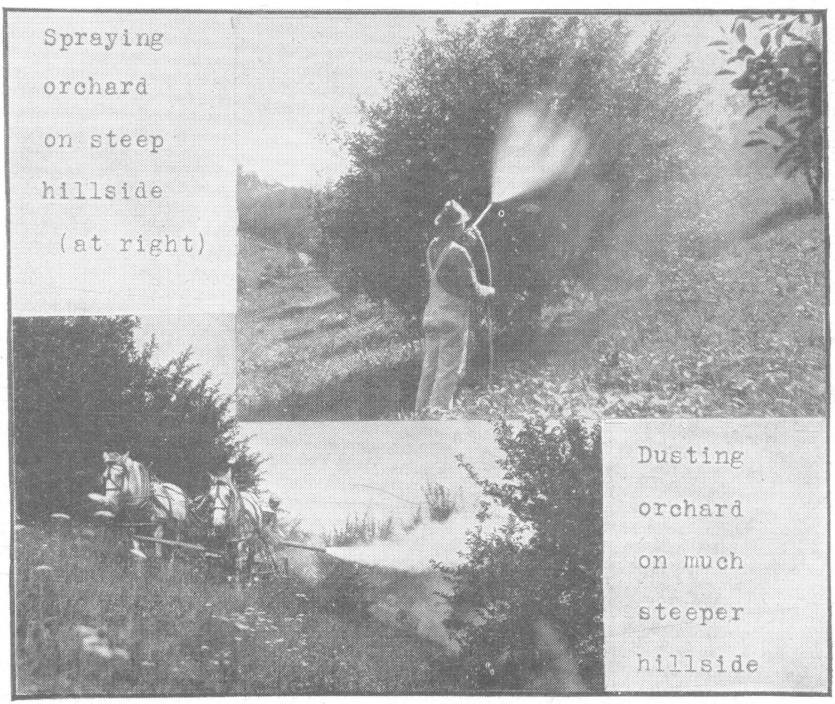

Fig. 5.—Spraying apple trees on a steep hillside (above). The spraying machine, not shown in the picture, is nearly 100 feet distant, farther up on the hillslope, standing in a graded driveway. Dusting an orchard (below) on a much steeper slope without the use of graded or terraced roadways.

However, in spite of the fact that an excellent, light-weight power sprayer was used, and that the water for spraying was supplied conveniently by hydrants under good pressure at a number of the hillside driveways, the task of spraying on the steep ground was more expensive than it would have been on land readily traversed in any direction. A single spraying of the 20 acres of trees required an average of 52 hours time for two men and a team of horses.

The advent of dusting changed this situation very materially. With the much lighter dusting machine, notwithstanding its equipment with a 6-horse-power motor, the hillsides were readily driven

over; altho the terraced or graded driveways still proved to be a source of considerable relief and satisfaction, and more of them are being cut in the more dangerous slopes as time permits.

With the usual working force of two men and a team a single dusting of 19 acres, plus the spraying of the 1-acre plot maintained in 1927 and 1928 for comparison, averaged about 10 hours, as against 52 hours for a single spraying of the total area. The average cost of dusting for the two seasons was 3.9 cents per bushel of apples, as against an average of 5.7 cents per bushel for spraying during the previous three seasons.

The fact should not be overlooked, however, that this dusting work was conducted on an experimental basis. A considerable number of plots were treated separately and with different dust formulas. This necessitated frequent cleaning out of the hopper of the dusting machine to remove the remnants of dust left as the various plots were finished. All of this occupied much additional time as compared with the usual, uniform treatment of the entire orchard area.

GASOLINE AND OIL FOR SPRAYING AND DUSTING

The gasoline and oil in the spraying and dusting operations averaged slightly less than one-half of one cent per bushel of apples for the full five-year period. Perhaps the more interesting point in connection with these items of cost is that changing from a 2½-horse-power motor in spraying in 1924-1926, to a 6-horse-power motor for dusting in 1927 and 1928, did not increase the expenditure for gasoline and oil. The less time required for dusting as compared with spraying, accounts for the slight reduction in favor of the dusting.

THINNING THE APPLES ON OVERLOADED TREES

While some experimental work in thinning apples on relatively small plots had been done in the orchard previously, the season of 1928 was the first in which such work was conducted as one of the regular operations entirely covering such portions of the orchard as were too heavily laden with fruit. Such thinning, as shown in the table, added 8.5 cents to the cost of growing a bushel of apples for the harvest of 1928. Undoubtedly, however, this expenditure was well justified; for in no preceding season were there ever so small percentages of undersize and "cull" apples. Thinning in June and July to reduce the clusters to single fruits and eliminate the more or less defective and undersized nubbins,

eliminated thousands of apples that would have been gathered as small and almost worthless fruit at harvest time at the regular price of 10 cents per bushel for picking. Moreover, the apples remaining on the trees attained much larger size than had they been seriously crowded by the great number removed. In addition, thinning saved branches from breaking, and permitted the trees to pass thru the season of fruit-bearing in much better physical condition than they otherwise could have done.

Fig. 6.—Thinning apples from overloaded trees of Stayman in the Dale View Orchard

MOWING THE ORCHARDS

References have been made to the grass-mulch plan of apple orchard management as being the only cultural practice safely and economically adapted to sloping and steep land. This method requires that the orchard area be kept in grass; that the grass be cut at least twice each season—the first mowing in June and the second in September, or shortly preceding the season for harvesting late autumn and winter apples; that the grass thus cut remain where it grew or be placed beneath the outer branches, thus gradually forming a soil cover or mulch.

Because of the steep slopes and the terraced driveways at frequent intervals in this orchard, the work of clipping the grass

with a mowing machine was much slower, more difficult, and hence more expensive than on comparatively level ground. So large a part of the orchard is inaccessible for the horse-drawn mower, that the work done with scythes very nearly equalled the cost of the work done by use of the mowing-machine.

Summer and autumn mowing of the grass included both machine and scythe work, as may be noted in the orchard expense account. During the five years this added an average cost of slightly more than 3 cents per bushel of apples.

PICKING THE APPLES AT HARVEST TIME

Of this particular orchard operation little need be said. In former years the apple pickers were hired by the day. This plan proved unsatisfactory not only to the employer but to the more observant and industrious employees, for the indifferent pickers were earning as much for their time as the conscientious ones. It was found at the close of 1924, the first season in cost accounting, that employing pickers by the day had cost an average of 11.6 cents per bushel. Hence a change was made for the years following to a flat rate of 10 cents per bushel. This rate is higher than that paid in some of the more southern apple-growing districts of the State, but barely sufficient to attract a desirable class of workers in central Ohio.

Picking-baskets were used until recently when a change was made to modern, adjustable picking-bags which open at the bottom and permit the apples to be deposited gently in the 1-bushel crates in which the fruit is hauled to the packing-house.

HAULING THE APPLES FROM ORCHARD TO PACKING-HOUSE

Where the orchard ground is as difficult to traverse as in this orchard, a good strong sled with slatted or boarded bottom and side-boards is the only practical means of transportation. Even at best this short haul was an expensive one, as may be observed by reference to the orchard cost account, and added an average of nearly 3½ cents per bushel of apples to the cost of production and handling.

GRADING AND PACKING THE FRUIT

The apples were sorted at the time they passed over the mechanical sizing machine and were immediately packed in 1-bushel baskets.

During the first three years the graded apples, which were sold principally to the local trade, simply were packed as evenly and firmly as possible in the baskets, with no special attempt to

"face" the packages. Such grading and this so-termed "jumble pack" cost an average of exactly 4 cents per bushel. However, at about this time a newly-developing demand for more uniform and attractive basket-packing of apples was accompanied by the introduction of a practical and efficient equipment for basket-facing. Such an outfit became a part of the packing equipment and was constantly in use during the last two apple-packing seasons.

While this new idea in basket-packing of apples is highly commendable and already has become popular, not only among orchardists but commission firms and dealers generally, nevertheless, the use of basket-facing devices has considerably increased the cost of packing as compared with the old and simple "jumble style." The extent of this increase is indicated in the table. Grading and packing cost an average of 8.8 cents per bushel of apples, exclusive of charges for supervision, as against the cost of 4 cents for the old style "jumble pack." There is no question but that the newer method is worth far more than it costs; for unattractively packed apples can hardly be sold at any price in the better markets since attractive basket-facing has come into vogue.

SUPERVISION OF GRADING AND PACKING

While this item of expense, in part at least, should be added to the cost of grading and packing as given above, the author prefers to present it separately for reasons which almost every orchard owner who supervises his own fruit grading and packing operations readily can appreciate.

Supervision by the foreman was not limited solely to keeping a watchful eye on all details of sorting, sizing, basket-facing, packing, lidding, stamping the lids with the variety and grade, temporarily storing in a part of the packing-house, and loading the auto truck for immediate transfer of the apples to cold storage in the city. It included additional personal service in many other ways and directions. The average cost of supervision was 3.06 cents per bushel.

INTEREST ON INVESTMENT IN ORCHARD MACHINERY AND EQUIPMENT

It is unnecessary to discuss this item of cost except very briefly. This charge against apple production will vary considerably and in proportion to the character and value of the machinery and tools used in orchard work. A practical illustration of the range in interest charges on investment in equipment may be found in the table. For the first four years of this account the

interest averaged but 1.7 cents per bushel of apples. In 1928 this item increased to 4.7 cents per bushel of fruit produced. There are two reasons for this: first, the total production of apples was somewhat less in 1928 than in 1926 and 1927; and, second, new and much more expensive equipment for spraying and dusting was purchased in the spring of 1928.

DEPRECIATION IN VALUE OF ORCHARD MACHINERY, AND REPAIRS

These items were counted at 10 percent per year, and amounted to an average of 3.8 cents per bushel of apples for the five years. For the same reason that interest on the investment in machinery and equipment abruptly advanced in amount in the year 1928 to double that of the years preceding, the charge per bushel of fruit for depreciation in value of such machinery became much higher in 1928. Doubtless there are orchardists and others who will object to so high a percentage of depreciation; but, everything taken into consideration, the author feels that 10 percent per year is not too great a discount in valuation. Certainly the selling price of orchard machinery, such as power sprayers and dusters, will decrease even to a greater extent than 10 percent per year, beginning with the next season following the purchase of a new outfit.

INTEREST ON ORCHARD LAND AND TAXES ON LAND AND EQUIPMENT

These items amounted to an average of 2.64 cents per bushel of apples per year for the five-year period.

TOTAL COST PER BUSHEL OF APPLES

The average total cost of producing, harvesting, grading, and packing ready for market or storage during the five years amounted to 69.84 cents per bushel. This cost reached its highest peak in the season of 1928 when a total of 90.4 cents per bushel was expended. In case the apples were not disposed of immediately but trucked to storage there should be added 7 cents per bushel for transportation and the initial storage fee which, whether the fruit remain in storage a day or a month, is 10 cents per bushel, or a total of $1.07 per bushel.

Without question the greater amount of satisfaction and encouragement to be gained from a careful study of the foregoing data and discussions, will be experienced by resident orchard owners. For these, not only by supervising their own orchard enterprises, but by personally participating in much of the work necessary to successful apple culture, may eliminate many cash expenditures that otherwise would be inescapable.

SUMMARY

That apple orchard management often is in combination with other farm enterprises accounts, in part at least, for the scarcity of definite data relating to costs of apple production.

Many orchard owners who do practice bookkeeping hesitate to charge against production of the apple crops such items as do not necessitate actual expenditure of money.

The average cost per bushel over a period of years, of apples produced in a poorly located orchard, almost invariably is far greater than the return to the grower.

Only from orchards situated in those sections that are naturally well adapted to regular as well as generous fruit production, may we hope to obtain fair and satisfactory detailed cost accounts of apple production.

Even at best the cost of growing apples will vary greatly in the same section as, in an upland or hilly locality there not only is a great diversity of soil types, qualities and productive possibilities, but wide variations due to different elevations and exposures.

Steep slopes and hillsides of upland and rugged sections are not adapted to frequent tillage and cultivation because of annual losses of soil and fertility by erosion.

In this experimental project in orchard cost accounting in central Ohio, all labor was hired, every item of cost paid for in cash and all charged to production and handling of the apples.

The apple grower who lives at his fruit farm, supervises his own orchard enterprises, and is personally active in the work of growing his crops, can produce apples less expensively and obtain a greater margin of profit than can the non-resident orchardist.

Trees well pruned admit sunshine and air, favor thoro spraying and dusting and produce higher percentages of apples of good size and color. The cost of such pruning, in the experiment under discussion, amounted to 3.04 cents per bushel of apples per year, over the five-year period.

Apple orchards in the upland sections of Ohio, necessarily under the grass-mulch plan of orchard culture, generally require generous fertilization with readily available nitrogenous plant food. The expense of such fertilization in the test amounted to slightly over 2 cents per bushel of apples.

The spraying materials cost slightly over 3 cents per bushel of apples, for the first three years of the test, during which spraying, exclusively, was practiced.

Dusting materials for the same orchard, (with the exception of 1 acre of trees continued under spray treatment) averaged 5.3 cents per bushel of apples for the two seasons of 1927 and 1928.

The work of applying the sprays in 1924-1926 cost an average of 5.7 per bushel of apples.

The work of applying the dusts in 1927 and 1928 cost an average of 3.9 cents per bushel.

Changing from spraying to dusting slightly decreased the amount of gasoline and oil consumed in generating motive power.

Thinning apples from all overloaded trees in 1928 added a cost of 8.5 cents per bushel; but results justified this expense.

Mowing the grass twice each season cost an average of slightly above 3 cents per bushel of apples.

Payment of a flat rate of 10 cents per bushel for picking apples was found to be a little less expensive than hiring labor by the day at prevailing local wages, and proved more satisfactory.

Hauling the apples from the hilly orchard land to the packing-house cost 3.5 cents per bushel.

The expense of sorting, sizing and packing the apples averaged 5.9 cents per bushel.

Supervision of grading, packing, and attention to local sales averaged about 3 cents per bushel.

Interest on the investment in orchard machinery and equipment amounted to 2.3 cents, and repairs and depreciation in their value to 3.8 cents per bushel.

Interest on the assessed valuation of orchard land plus taxes on land and equipment amounted to 2.6 cents per bushel.

In this experiment the total cost of producing and preparing the apples for sale amounted to 76.6 cents per bushel.